



**U.S. Army Research Institute  
for the Behavioral and Social Sciences**

**Research Report 1721**

**Assessment of the SIMITAR Gunnery Training  
Strategy Through Development of a Database of  
Gunnery Outcome Measures**

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**U.S. Army Research Institute  
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**A Directorate of the U.S. Total Army Personnel Command**

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14. ABSTRACT (Maximum 200 words): This report assesses the impact of the Simulation in Training for Advanced Readiness (SIMITAR) compressed gunnery training strategy for Army National Guard (ARNG) armored and mechanized infantry units. This strategy emphasizes the use of state-of-the-art training aids, devices, simulators, and simulations (TADSS) in response to challenges posed by time and range constraints experienced by ARNG combat units. Assessment entailed development of a longitudinal database of gunnery-related information generated before (1993-1994) and during (1995-1997) SIMITAR strategy implementation (see Smith, in publication). This information was collected from armored and mechanized infantry units from a SIMITAR test brigade and from six enhanced no SIMITAR "comparison" brigades. Overall, the SIMITAR training strategy was successful. Results showed that final, crew-level, tank gunnery qualification on Table VIII did not differ either between the SIMITAR and comparison units, or within the SIMITAR test unit, across data collection years. Bradley Fighting Vehicle Table VIII qualification rate, however, did favor the comparison units. Perhaps more importantly, the SIMITAR strategy permitted most (94%) fully staffed SIMITAR platoons to complete gunnery Table XII (with a 45% overall qualification rate) and enabled company and higher level maneuver training objectives to be accomplished, all within a normal 39-day yearly training calendar. Suggestions for research needed to extend SIMITAR training strategy benefits are provided.					
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**Research Report 1721**

# **Assessment of the SIMITAR Gunnery Training Strategy Through Development of a Database of Gunnery Outcome Measures**

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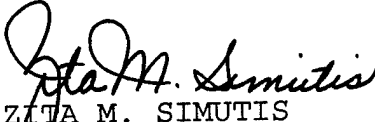
## FOREWORD

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The Army National Guard (ARNG) is seeking to place greater emphasis on the use of training aids, devices, simulators, and simulations (TADSS) to make an order-of-magnitude difference in the effectiveness and efficiency of Abrams Tank and Bradley Fighting Vehicle gunnery training. To this end, Project SIMITAR (Simulation in Training for Advanced Readiness) has developed a TADSS-oriented, time-compressed gunnery training strategy designed to enable yearly conduct of both crew- and platoon-level gunnery, as well as company and higher level maneuver, training among ARNG armored and mechanized infantry units. This report describes the successful impact of this strategy, as adopted in an ARNG armored brigade.

This research was conducted by the U.S. Army Research Institute for the Behavioral and Social Sciences Reserve Component Training Research Unit (RCTRU), whose mission is to improve the effectiveness and efficiency of RC training through use of the latest in training technology. The research task supporting this mission, "Train Up: Technology-Based RC Training Strategies," is organized under Science and Technology Objective III.P.02, Unit Training Strategies.

The National Guard Bureau (NGB) sponsored this research under a continuing Memorandum of Understanding initially signed 12 June 1985. Findings have been presented to Director, Project SIMITAR; Chief, Training Division, NGB; Commander, 116<sup>th</sup> Cavalry Brigade.

  
ZITA M. SIMUTIS  
Technical Director

# ASSESSMENT OF THE SIMITAR GUNNERY TRAINING STRATEGY THROUGH DEVELOPMENT OF A DATABASE OF GUNNERY OUTCOME MEASURES

## EXECUTIVE SUMMARY

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### Research Requirement:

Assess impact of the Simulation in Training for Advanced Readiness (SIMITAR) time-compressed gunnery training strategy for Army National Guard (ARNG) armored and mechanized infantry units.

### Procedure:

Gunnery measures were collected in an enhanced ARNG armor test brigade both before (1993-1994) and after (1995-1997) implementation of the SIMITAR time-compressed gunnery training strategy. Similar measures were also collected in six enhanced "comparison" armored and mechanized infantry brigades that did not train under the SIMITAR strategy. Data from test and comparison units were stored in a Statistical Package for the Social Sciences (SPSS) database (see Smith, in publication) designed to facilitate assessment of SIMITAR strategy impact on gunnery performance.

### Findings:

Final, crew-level, tank gunnery qualification on tank Table VIII did not differ between test and comparison units, or within the test unit itself, across data collection years. Bradley Fighting Vehicle Table VIII qualification rate, however, did favor the comparison units. More importantly, the SIMITAR strategy permitted most (94%) fully staffed SIMITAR platoons to complete gunnery Table XII (with a 45% overall qualification rate) and enabled company/higher level maneuver training objectives to be met, all within the normal 39-day yearly training calendar.

### Use of Findings:

The findings of this assessment demonstrate that, through emphasis on the use of training aids, devices, simulators, and simulations (TADSS) under the SIMITAR time-compressed gunnery training strategy, ARNG armored and mechanized infantry units can successfully accomplish crew- and platoon-level gunnery, as well as company and higher level maneuver, training and evaluation within a normal training calendar year. Suggestions for research needed to extend the benefits of this strategy even further are provided.

# ASSESSMENT OF THE SIMITAR GUNNERY TRAINING STRATEGY THROUGH DEVELOPMENT OF A DATABASE OF GUNNERY OUTCOME MEASURES

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# Assessment of the SIMITAR Gunnery Training Strategy Through Development of A Database of Gunnery Outcome Measures

## Introduction

A major outcome of Operation Desert Storm was heightened recognition of the need to enhance the training readiness status of Reserve Component (RC) combat units designated for rapid deployment (Krug & Pickell, 1996). Since development of the concept of "Roundout" or "Roundup" brigades, some Army National Guard (ARNG) combat brigades have been expected to be deployable shortly after the deployment of Active Component (AC) units. With the more recent introduction of the concept of "enhanced" brigades, 15 ARNG combat brigades (including 7 former Roundout/up brigades) currently have the responsibility for reinforcing or augmenting AC units, in the event that the latter are unable to handle two or more simultaneous, or nearly simultaneous, regional conflicts (Government Accounting Office [GAO], 1995). These enhanced brigades include armor, armored cavalry, and mechanized as well as light infantry (Headquarters, U.S. Army Training and Doctrine Command, 1993).

The need for rapid deployment in today's world is beyond question. As front page headlines often illustrate, international "hotspots" can develop virtually overnight anywhere in the world. With the end of the "cold war," our nation's defense strategy has shifted from a focus on deterrence of global war with the former Soviet Union to an emphasis on rapid deployment of forces to contain regional conflicts, such as aggressions against the Persian Gulf region. With 28 nations around the globe having 1,000 or more main battle tanks (GAO, 1995), the need for combat readiness among our armed forces has never been greater. Rapid deployment and optimal mobility of our armed forces, therefore, is critically important to safeguarding world freedom.

This demand for continual vigilance occurs at a time when resources are becoming increasingly scarce. The Army has experienced substantial personnel and budgetary reductions, and is likely to experience additional cutbacks in the future as a result of the lessening of tensions between the world's two superpowers (McAndrews, 1997). RC forces are continuously plagued with another kind of scarcity, the shortage of available training time. Compared to AC units, RC units have fewer than 20% of available training days (U.S. Army Training Board, 1987). In spite of this, Total Force Policy holds that RC units must train to readiness levels comparable to those of their AC counterparts.

To ensure compliance with these requirements in regard to gunnery, for example, enhanced RC armor and mechanized infantry units are looking to advanced training aids, devices, simulators, and simulations (TADSS) and associated usage strategies for help. Only through use of state-of-the-art TADSS technologies can RC gunnery training proceed apace with AC

standards, notwithstanding potential handicaps imposed by time and range constraints unique to the RC training environment.

### Simulation in Training for Advanced Readiness (SIMITAR)

Project SIMITAR was a direct outgrowth of the perceived need to ensure that technology is used effectively and efficiently to meet current RC training readiness requirements. Established by Congress in 1992 as an Advanced Research Projects Agency (now the Defense Advanced Research Projects Agency) effort, SIMITAR's goal is to use TADSS to achieve "an order-of-magnitude increase in the training readiness of ARNG combat brigades" (Krug & Pickell, 1996, p. 57). SIMITAR objectives include the development of new TADSS, the provision of distributed simulation to soldiers in training, and the development of training scenarios/exercises and performance measures.

SIMITAR promotes a three-tiered training strategy. The first tier consists of battlefield synchronization training at the battalion and brigade level, achieved through Janus simulation delivered to commanders and staff officers at their home-station armories.

The second tier, small unit collective training, employs an array of TADSS in order to enhance individual and small unit skills. To achieve full-crew simulation of tank gunnery, driving, and command operations, the Abrams Full-Crew Interactive Simulation Trainer (AFIST) is employed. The AFIST attaches to an unpowered tank and provides realistic main battle tank simulation (including precision gunnery) at home-station armories. The Bradley Full-Crew Interactive Simulation Trainer (FIST-B) performs similar training functions for BFV crews, with the added capability of training soldiers dismounted from the BFV. Further marksmanship and squad-level maneuver training of dismounted soldiers is accomplished with the Engagement Skills Trainer (EST).

Platoon-, company-, and battalion-level exercises are supported by the enhanced mobile simulation network (SIMNET). Enhanced SIMNET incorporates a number of technological upgrades, including improved image generation, integration of the automated training analysis and feedback system's (ATAFS) after-action review (AAR) capabilities, and development of electronic terrain databases for Fort Stewart, GA, and the Orchard Training Area (OTA) near Gowen Field, ID. The Advanced Research Projects Agency Reconfigurable Simulator (ARSI) can simulate the maneuver capabilities of an Abrams Main Battle Tank, a Bradley Fighting Vehicle (BFV), or a high-mobility, multipurpose wheeled vehicle. ARSI has more advanced image generation capabilities (e.g., night, fog, rain, and smoke) than SIMNET. It also offers the same terrain databases as SIMNET, with enhanced AAR capabilities.

The Deployable Force-on-Force Instrumented Range System (DFIRST) supports company-level force-on-force training exercises, in the manner of those conducted at the National Training

Center (NTC) at Fort Irwin, CA. Although not developed under SIMITAR, the Conduct-of-Fire Trainer (COFT) has also been implemented in ARNG units as part of SIMITAR's overall training initiative. COFTs are used to train both tank and BFV commander/gunner pairs in high-fidelity simulations of precision gunnery engagements.

The third tier in the SIMITAR strategy consists of individual and small group Combat Service Support (CSS) training using TADSS, other computer-based training, and training packages for forward support battalions. These training packages, based on unit-level, mission-oriented approaches, permit training in a variety of support missions at a high level of realism. TADSS in this area include the Triage Medical Trainer (TMT) and the Virtual Reality Maintenance Trainer (VMAT). The TMT simulates soldiers with a variety of injuries and forces the trainee to triage based on presented conditions. The VMAT supports training in internal combustion engine maintenance and repair procedures.

Full implementation of the SIMITAR strategy involves a coordinated application of all three training tiers. In each tier, SIMITAR training entails not only TADSS, but also the application of techniques and strategies that specify their optimal use (Grady, 1994; Krug & Pickell, 1996). The present research is concerned with the impact of the SIMITAR initiative on crew- and platoon-level gunnery training. This performance area falls under the second training tier, as described above.

In the realm of gunnery training, it is expected that through use of TADSS, participating units will benefit from enhanced realism of gunnery tasks, improved feedback, and increased gunnery practice opportunities. Moreover, part of the proposed advantages of SIMITAR is that affected units will be able to progress beyond an exclusive focus on gunnery training and also address maneuver training objectives in the same training year. Under SIMITAR, gunnery and maneuver tactics are interdependent. Thus, two operational goals are central to the proposed SIMITAR gunnery training strategy: (a) compression of traditional gunnery training activities through the implementation of cutting edge TADSS technologies, and (b) attainment of tactical maneuver training objectives within the limited time constraints of the traditional RC training calendar year.

#### Enhanced Brigades and the SIMITAR Gunnery Training Strategy

The unit chosen to test the impact of TADSS when used within a coordinated SIMITAR training strategy was an ARNG enhanced armor brigade. Such units comprise the following maneuver elements: two armor battalions, one mechanized infantry battalion, and one armored cavalry (CAV) troop. Implementation of TADSS (within both tank and BFV test battalions) was accompanied by introduction of a SIMITAR compressed gunnery training strategy. This strategy is designed to:

- Train combat-ready tank and BFV crews and platoons
- Fully exploit the use of TADSS
- Maximize the use of resource-intensive live fire training time by building crew proficiency in less resource-intensive simulation training environments
- Maximize the number of practice repetitions within the available training time
- Permit gunnery and maneuver training during the same training year
- Qualify crews on Tank Table VIII and platoons on Tank Table XII in the same training year

### *Compressed Gunnery Training for Abrams Tank Battalions*

The SIMITAR strategy (Department of Defense, 1994; Shaler, 1995) explicitly recognizes the limited training time available to ARNG units (39 days of combined Inactive Duty Training [IDT] and Annual Training [AT] per year). By taking advantage of TADSS, the compressed strategy attempts to achieve crew-level gunnery qualification on Table VIII and platoon-level gunnery/maneuver qualification on Table XII, all within the limited training window. Compressed tank gunnery training is anchored in FM 17-12-1-1, Volumes I and II (Headquarters, Department of the Army, 1992), and focuses on the tasks and skills essential to producing combat-ready tank crews and platoons by taking maximum advantage of the latest advances in TADSS technology, particularly the AFIST, COFT, SIMNET and ARSI.

TADSS are used two ways in the compressed strategy. In some cases, TADSS are used to accomplish specific outcomes which are tied to particular training segments (such as successfully firing Table VII on AFIST). The other recommended use of TADSS is as remedial/sustainment trainers, where each unit has them available during IDT or AT or during Readiness Management Assemblies (RMAs) to enable crew training to be scheduled on a concurrent basis. This remedial/sustainment training enables new or weak crews to have readily available training opportunities to improve proficiency without obstructing the flow of other company elements during IDT/AT gunnery.

The compressed gunnery training year is broken down into discrete training segments. Each IDT segment consists of either four or five Unit Training Assemblies (UTAs). (A UTA is a 4-hr block of instruction.) Each AT segment consists of either one or two training days. (A training day is either an 8- or 12-hr block.) Specific training objectives are linked to each training segment. The Abrams compressed gunnery strategy is depicted in Tables 1 and 2. Table 1 shows the IDT component and Table 2 shows the AT component. Both tables are adapted from Shaler (1995).

The Abrams strategy contains six IDT segments and five AT segments. As indicated in Tables 1 and 2, both the AFIST and SIMNET assume specific training roles in the prescribed regimen. Moreover, the compressed strategy also states that in addition to its formal training roles, the AFIST should be used for remedial/sustainment training during both IDT and AT

segments. COFT also appears in both tables, indicating that it as well as AFIST should be continuously available throughout the training year, during both IDT and AT training segments to facilitate remedial/sustainment training.

Table 1

*SIMITAR Compressed Tank Gunnery Training Strategy; IDT Component*

IDT						
Training Segment:	#1	#2	#3	#4	#5	#6
UTAs:	1-4	5-8	9-13	14-18	19-22	23-27
Training Objectives:	Preliminary Gunnery & Individual Skills Training	TCGST	TCPC (Tank Table IV) on AFIST	Tank Table V plus Subcaliber Main Gun (Live)	Tank Table VII on AFIST	Tank Table VI including SCREEN (Live)
COFT/AFIST Remedial/Sustainment Training						

*IDT component.* The SIMITAR compressed gunnery training strategy occupies 27 out of a total of 48 UTAs, or slightly over half the total available IDT training time. The first four UTAs, comprising the first SIMITAR training segment, ordinarily occur as one multiple UTA (MUTA 4) weekend early in the training year. This training segment is devoted to preliminary gunnery and individual tasks/skills. The primary purpose of this first training segment is the introduction of individual and crew gunnery tasks/skills, leading to a mastery of the fundamentals of safety, communication, and maintenance. The first training segment may not be contiguous with the remainder of compressed gunnery training activities. That is, other training activities may be interspersed between the first and second SIMITAR training segment.

Completion of the Tank Crew Gunnery Skills Test (TCGST) is linked to the second IDT segment (UTAs 5-8). The TCGST is used to evaluate each tank crew member's ability to execute selected tank gunnery-related tasks/skills. It can also be used to identify crew gunnery strengths and weaknesses. Once the TCGST is passed, current training policy requires completion of Table VIII within 6 months. In order to meet this requirement, training segments 2 through 6 are ordinarily conducted in contiguous months.

TADSS are not necessary for either of the first two segments of IDT gunnery training, but they become centrally important beginning with the third segment, where the AFIST becomes the training centerpiece. The main objective of this segment is successful completion of Tank Table IV (also called the Tank Crew Proficiency Course [TCPC]) on the AFIST in accordance with the tasks, conditions, and standards prescribed in FM 17-12-1-1. Tank Table IV (TCPC) determines the crew's ability to engage stationary and moving targets from a stationary and moving tank and serves as the qualification table for basic tank gunnery. This training objective is completed via a logistic practice known as the "pile-on" weekend.

According to Shaler (1995), the pile-on strategy facilitates tank crew training within a company setting by minimizing travel time and maximizing training time. To achieve full benefit from TADSS, all AFISTs available to a battalion are consolidated at a single location (an armory, a Maintenance and Training Equipment Site [MATES], or a local training area) and operated around the clock. Intact platoons are then rotated through AFIST training. When a platoon is not training on AFIST, it engages in other training, such as maneuver training on SIMNET or ARSI, maneuver training using live tanks, additional COFT training, maintenance training using tanks, or individual crew skills training.

Referring back to Table 1, it can be seen that training in IDT Segment 4 involves live fire. The objective of this training segment is to conduct Tank Table V, a machine gun exercise, and, time permitting, to fire selected engagements of Tank Table VI (preliminary main gun training) using subcaliber in-bore devices.

The fifth IDT segment again makes use of AFIST within the context of pile-on weekends. The training objectives of this segment are to exploit fully the capabilities of AFIST in order to conduct Tank Table VII. Tank Table VII requires the use of all knowledge gained from previous gunnery training exercises/tables and serves as practice for Table VIII.

The sixth, and final, IDT segment requires use of the tank gunnery range. This segment focuses on crew use of the muzzle boresight device, the proper conduct of prepare-to-fire checks and armament accuracy checks. Training in this segment concludes with Tank Table VI using the tank main gun, firing full-caliber ammunition to engage stationary and moving targets from a stationary tank.

*AT component.* Table 2 shows the AT component of the SIMITAR compressed tank gunnery training strategy. Only the first 7 AT Days are devoted to the gunnery component of the SIMITAR strategy. The remaining AT Days are set aside for maneuver training.

The first Day of AT (training segment 7) is devoted principally to make-up Table IV (TCPC), Table VI (SCREEN), and TCGST, using Abrams Tanks at the AT tank gunnery range. This training segment is for tank crews that failed to pass the TCGST during Segment 2 of IDT, Table IV during Segment 3 of IDT, or Table VI during Segment 6 of IDT.

Days 2 and 3 of AT constitute training Segment 8 and are devoted to Tank Table VIII qualification. Table VIII is the qualification course for tank crews and is the end-objective of AT during gunnery training years in the current (conventional) training strategy. In the compressed strategy, however, it is scheduled for completion no later than the third Day of AT.

Table 2

*SIMITAR Compressed Tank Gunnery Training Strategy; AT Component*

AT					
Training Segment:	#7 <sup>a</sup>	#8	#9	#10	#11
AT Days:	AT Day 1	AT Days 2&3	AT Day 4	AT Day 5	AT Days 6&7
Training Objectives:	Make-up Tank Table IV, Make-up Table VI (SCREEN) & TCGST	Tank Table VIII Crew Qualification (Live)	Platoon Tactical Training (SIMNET)	Tank Table XI (SIMNET) Plus Rehearsal of Tank Table XII	Tank Table XII Platoon Qualification (Live)
COFT/AFIST Remedial/sustainment Training					

<sup>a</sup> SCREEN = Follow-up to muzzle boresighting where rounds are fired for a calibration check.

AT Days 4 and 5 (training segments 9 and 10) use SIMNET. Segment 9 is devoted to platoon-level tactical training (e.g., movement to contact, hasty defense, hasty attack, leaders' reconnaissance). Segment 10 is devoted to Tank Table XI and trains the platoon sections to control and distribute direct fire.

Tank Table XII platoon-level gunnery qualification is scheduled for Segment 11 during AT Days 6 & 7. This table requires the integration of fire and maneuver training while engaging moving and stationary targets with the full array of tank weapons systems during daylight and periods of limited visibility. Beyond training segment 11, a final AT goal of the SIMITAR compressed gunnery strategy is a venue of higher-echelon (i.e., company and battalion) maneuver skills training.

*Compressed Gunnery Training for BFV Battalions*

The strategy for BFV units varies somewhat from that described above for tank units, but the overall objectives are identical (Department of Defense, 1994). Both tank and BFV strategies use a combination of IDT and AT days in order to achieve crew-level gunnery qualification on Table VIII as well as platoon-level gunnery/maneuver qualification on Table XII, all within a limited training window. Both strategies focus on the tasks and skills essential to producing combat-ready crews and platoons by taking maximum advantage of the latest advances in TADSS technology.

As with tank gunnery training, TADSS are used two ways in the BFV training strategy. In some cases, TADSS are used to accomplish specific training objectives (such as successfully firing BFV Table V using FIST-B). Otherwise, TADSS are recommended for use as remedial/sustainment trainers, available at each unit during IDT or RMAs to enable crew training to be scheduled on a concurrent basis. This remedial/sustainment training enables new or weak



crews to have readily available training opportunities to improve proficiency without obstructing the flow of other company elements during IDT gunnery training.

The compressed BFV gunnery training year is broken down into discrete training segments. Each IDT segment consists of either four or five UTA's and each AT segment consists of a single training day. Specific training objectives are linked to each training segment. The BFV compressed gunnery strategy is depicted in Tables 3 and 4. Table 3 shows the IDT training component and Table 4 shows the AT component. Both tables are adapted from Department of Defense (1994).

*IDT component.* The five IDT training segments of the BFV strategy are shown in Table 3. COFT, FIST-B, and SIMNET assume specific training roles in the prescribed regimen. To optimize use of these TADSS, the pile-on concept is used in the BFV test battalion in the same manner that it is used in the tank battalions.

Table 3

*SIMITAR Compressed BFV Gunnery Training Strategy; IDT Component*

IDT					
Training Segment:	#1	#2	#3	#4 <sup>a</sup>	#5 <sup>b</sup>
UTAs:	1-4	5-8	9-13	14-18	19-23
Training Objectives (Mounted):	Individual Weapons Qualification and Individual Training	Preliminary Gunnery (COFT or FIST-B)	BFV Gunnery Skills Test and Individual Skills	BT V (BCPC) Subcaliber or FIST-B; COFT remedial/sustainment	Crew Fire Team Exercise (MILES)
Training Objectives (Dismounted):	Individual Weapons Qualification and Individual Training	Fire Team Special Weapons	Squad Fire Coordination Exercise/EST	Squad Tactical Training	Crew Fire Team Exercise
COFT/FIST-B Remedial/Sustainment Training					

<sup>a</sup> BT = Bradley Table; BCPC = Bradley Crew Proficiency Test

<sup>b</sup> MILES = Multiple Integrated Laser Engagement System

The first training segment, consisting of the first four UTA's of the training year, is devoted to individual weapons qualification and other individual training. These activities are applicable to both mounted and dismounted training objectives and do not involve TADSS. However, gunnery training as it relates to BFV weapons is primarily confined to mounted objectives. Accordingly, only mounted objectives are discussed in the following sections.

Preliminary gunnery training using COFT or FIST-B is the target of the second IDT segment (UTAs 5-8). This training concerns itself with such gunnery preliminaries as loading, unloading, boresighting, and handling misfires. The third segment is devoted to assessment, training, and retraining of basic gunnery tasks. The fourth segment is performed on BFVs equipped with subcaliber in-bore devices at the gunnery range, or on simulation devices in an armory setting. The objective of this training segment is to conduct BFV Table V, day and night tasks, from stationary and moving BFVs. COFT is used for remedial/sustainment training. The fifth, and final, IDT training segment (Crew Fire Team Exercise) entails integrated mounted/dismounted training. It involves battle drills, tactical moves, engagement of targets from a moving BFV, engagement of targets with Tube-launched, Optically tracked, Wire-guided (TOW) missiles, and a variety of mounting and dismounting drills.

*AT component.* Table 4 shows the AT component of the SIMITAR compressed BFV gunnery training strategy. Nine AT training days are devoted to the SIMITAR strategy. One training segment is devoted to each day. The remaining AT days are set aside for maneuver training.

Table 4  
*SIMITAR Compressed BFV Gunnery Training Strategy; AT Component*

AT									
Trng Seg:	#6 <sup>a</sup>	#7 <sup>b</sup>	#8 <sup>c</sup>	#9	#10	#11	#12	#13	#14
AT Days:	1	2	3	4	5	6	7	8	9
Trng Objectives (Mtd):	Prep BT VII (COFT or FIST-B)	BT VII (Live) (COFT or FIST-B: concurrent)	BT VIII (Live) (COFT or FIST-B: concurrent)	Prep BFV Section or Squad Exercise (SIMNET or ARSI)	BFV Section or Squad Exercise (MILES)	Prep BFV Platoon Pro-ficiency Course (SIMNET or ARSI)	BFV Platoon Pro-ficiency Course (MILES)	BT XI SIMNET or ARSI)	BT XII (Live)
Trng Objectives (Dis-mtd):	Squad Tac. Trng (MILES)	PCI Squad Rhrl	Squad STX & LFX (Live)						

Note. Trng = Training; Seg = Segment; Mtd = Mounted; Dismtd = Dismounted

<sup>a</sup> Prep = Preparatory; BT = Bradley Table; Tac = Tactical; MILES = Multiple Integrated Laser Engagement System

<sup>b</sup> PCI = Pre-combat inspection; Rhrl = Rehearsal

<sup>c</sup> STX = Situational Training Exercise; LFX = Live Fire Exercise

On the first Day of AT (training segment 6), COFT or FIST-B exercises are practiced in preparation for Bradley Table VII, which is live fired on Day 2, while COFT or FIST-B is used for remedial/sustainment training. On Day 3 of AT, Bradley Table VIII is live fired and COFT or FIST-B is available for remedial/sustainment training. In the compressed strategy, Bradley Table VIII is scheduled for completion on Day 3 of AT.

Either SIMNET, FIST-B, or ARSI is used on Day 4 of AT to prepare for the BFV section/squad exercise, which is performed for record on Day 5 of AT using the Multiple Integrated Laser Engagement System (MILES) to simulate live-fire effects. Either SIMNET or ARSI is used on Day 6 to prepare for the BFV Platoon Proficiency Course, which is performed for record on Day 7 using MILES. Day 8 is devoted to practicing Bradley Table XI on either the SIMNET or the ARSI and Day 9 of AT is given over to live firing Bradley Table XII. This table serves as the gunnery qualification course for BFV platoons. It requires the integration of fire and maneuver training while engaging moving and stationary targets using the full array of BFV weapons systems during daylight and periods of limited visibility. After qualifying on Table XII, a final goal of the SIMITAR BFV compressed gunnery strategy is to provide a venue for higher echelon (e.g., company and battalion) maneuver skills training.

### Method

#### *Test Brigade*

The test brigade selected for implementation of the SIMITAR training program/strategy was the 116th Cavalry Brigade of Idaho, Montana, and Oregon. This brigade consists of two armor battalions, one mechanized infantry battalion, and a cavalry troop:

116th Cavalry Brigade – Idaho, Montana, Oregon  
2-116 AR  
3-116 AR  
1-163 IN (Mech)  
G/82 CAV

#### *Comparison Brigades*

Six enhanced ARNG brigades were asked to provide gunnery information for comparison purposes. These brigades are located in Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, and Washington. These brigades were selected to be comparable to the test brigade, but received none of the SIMITAR strategy interventions. They continued in their usual training patterns, alternating gunnery and maneuver training years. Their battalion-level compositions are shown below.

256th Infantry Brigade (Mech) – Louisiana  
1-156 AR  
2-156 IN (Mech)  
3-156 IN (Mech)  
E/256 CAV

155th Armor Brigade – Mississippi

1-198 AR  
2-198 AR  
1-155 IN (Mech)  
E/98 CAV

30th Infantry Brigade (Mech) – North Carolina

1-252 AR  
1-119 IN (Mech)  
1-120 IN (Mech)  
E/196 CAV

218th Infantry Brigade (Mech) – South Carolina

2-263 AR  
1-118 IN (Mech)  
4-118 IN (Mech)  
B/202 CAV

278th Armored Cavalry Regiment – Tennessee

1-278 ACS  
2-278 ACS  
3-278 ACS  
Unstaffed

81st Infantry Brigade (Mech) – Washington

1-303 AR  
1-161 IN (Mech)  
3-161 IN (Mech)  
E/303 CAV

*Procedure*

*Armor battalions.* To support the compressed gunnery training strategy, four AFISTs, two COFTs, and one SIMNET were made available to each armor battalion in the test brigade. These devices (and the accompanying training strategy) were fielded in January, 1995.

As the strategy evolved, pile-on weekends became a central focus of the test brigade's efforts. Observers of the implementation reported that the pile-on concept was more successful in one armor battalion than the other. One battalion was plagued with physical limitations imposed by several of its armories (small size, outdated wiring, inadequate temperature

regulation). Some armories, for instance, could not simultaneously accommodate multiple main battle tanks and all the associated AFIST peripherals, required elements of the pile-on training concept. Above and beyond the extraordinary demands posed by the AFIST equipment in terms of physical space, temperature regulation, and electrical wiring, there was also the problem of constant disassembly and reassembly of the AFISTs as they were moved from one armory to the next. Full-time staff, particularly at the battalion level, were taxed to continuously relocate the equipment. In order to alleviate the stress on personnel and equipment, pile-on weekends were centralized in 1996 at the MATES facility serving OTA near Boise, Idaho.

Centralization of pile-on weekends eliminated the need to constantly relocate equipment, reduced stress on the personnel assigned to monitoring and maintaining equipment, and increased the ability to train some types of engagements on the nearby live-fire range that are not handled by AFIST (i.e., engagements involving simultaneous use of the main gun and the TC's Caliber 50 machine gun). The central location arrangement introduced a new set of complications, however, because the firing range was significantly more accessible to one of the two test armor battalions than the other. Thus, one of the two test armor battalions suffered the double handicap of physically limited armories when they attempted to implement the pile-on concept locally and significantly longer travel distances in order to reach the OTA when pile-ons were centralized at that location. The combination of armories with limited amenities and greater travel distances has meant less success with implementing the pile-on concept in the second test battalion.

It should be pointed out that all features and timetables of the SIMITAR strategy were originally posited as ideals, any of which could be modified to reflect local conditions. An example of how the strategy was altered during implementation can be found in the way that the test brigade met Table VIII requirements. Although the SIMITAR strategy recommends that Table VIII be completed no later than the third Day of AT, crews in the test brigade have in many instances arrived at AT with this traditional hurdle already completed. This practice has been widespread in the armor battalion with easier access to the OTA, but to some extent it has been practiced in both test armor battalions since 1996. (Crews arriving at AT without having pre-qualified on Table VIII were expected to qualify during segment 8 training.) In contrast, the test brigade's armored CAV unit chose to stick with the official compressed strategy recommendations. Accordingly, in 1997 it fired Tables VIII and XII on the schedule specified in Table 2. The issue of when to schedule Table VIII qualifications within the compressed training schedule is still under discussion. This issue will be revisited in the discussion section of this report.

*BFV battalion.* The SIMITAR BFV test battalion (1-163 Infantry Battalion [Mechanized]) was formed in 1995 and engaged in New Equipment Training (NET) prior to October 1996 when it became a SIMITAR test unit with implementation of the BFV compressed gunnery training

strategy. To support the SIMITAR training initiative, the following devices were fielded in October, 1996: two ARSIs, two COFTs, and one EST. In April, 1997, a FIST-B was fielded.

As with armor units of the SIMITAR test brigade, the BFV test battalion chose to deviate from the recommended training strategy and complete Table VIII qualification firing during IDT. Thus, in 1997 the BFV battalion arrived at AT with Table VIII behind it, ready to focus on Table XII and tactical training objectives.

### *Performance Measures*

For the years 1993-1997, participating brigades were asked to provide gunnery performance data for each of their armor and mechanized infantry units. The 1993-1997 time period was selected to provide a pre-SIMITAR baseline (1993-1994) and a subsequent period (1995-1997) during which the SIMITAR training was to be implemented within the test units but not within the comparison units. This arrangement was designed to provide pre-post comparisons within either test or comparison units as well as comparisons between test and comparison units either before or after the SIMITAR intervention.

The arrangement worked better among armor units than among their BFV counterparts. BFV gunnery comparisons were complicated by the fact that the test BFV battalion was not formed until 1995 and then was involved in NET until the 1997 training year. Thus, the test BFV battalion did not fire Table VIII or Table XII during the 1993-1996 period, precluding any comparisons during those years.

The following information was requested from each company and battalion: (1) Table VIII and Table XII (if applicable) scoresheets for individual crews/platoons, (2) rollups of Table VIII engagement scores by crew, (3) rollups of Table VIII total scores by crew, (4) an indication of whether each crew qualified during its Table VIII first run, and (5) an indication of whether each crew eventually qualified on Table VIII, regardless of the number of required reruns. Additionally, the SIMITAR test brigade was asked to provide AT crew rosters by company by battalion and final battalion training calendar/schedule (to include IDT and AT activities).

Table VIII scoresheets and supporting rollup information were obtained from test tank battalions for 1993 through 1997 and from the test BFV battalion for 1997. Among comparison units, however, scoresheets were not available until 1996. For the early years of the project, data were submitted via unit rollups. Unfortunately, these rollups did not contain first-run Table VIII scores for crews that did not qualify on the first run.

*Table VIII scores.* Table VIII serves as the crew qualification exercise in both tank and BFV gunnery training. It assesses a crew's ability to engage moving and stationary targets from a moving and stationary tank or BFV during daylight as well as periods of limited visibility. Table

VIII consists of 10 engagements (normally 5 day and 5 night) selected from a pool of 12. Each Table VIII tank engagement is scored from 0 to 100 points, with 70 considered to be a passing score. Scores on individual engagements are summed to yield a total score, with a possible range of 0 to 1,000 points. Minimum scores of 70 on at least 7 engagements and a total score of at least 700 are required for qualification (Headquarters, Department of the Army, 1992).

Prior to 1997, BFV Table VIII was scored in the same manner as Tank Table VIII, producing individual engagement scores that could range from 0 to 100 and a total score from 0 to 1,000. Beginning with the 1997 training year, however, the Bradley scoring procedure was changed (Headquarters, Department of the Army, 1996). The new scoring procedure resulted in a rating of each engagement as trained (T), needs practice (P), or untrained (U) based on an array of engagement task and subtask standards. In the new evaluation system, Table VIII qualification requires T or P ratings on 7 of 10 engagements with at least 1 of the 7 being a Nuclear, Biological, and Chemical (NBC) engagement and at least 2 of the 7 being night engagements. As a result of these changes, no BFV Table VIII quantitative scores were available in the 1997 training year. Thus, comparisons were restricted to the percentage of crews attaining Table VIII qualification.

*Table XII scores.* Table XII serves as the qualification exercise in both tank and BFV platoons. It contains gunnery and tactical components and requires the platoon to demonstrate both fire and maneuver skills while engaging stationary and moving targets in offensive and defensive scenarios during daylight as well as periods of limited visibility. Platoons are evaluated on target hit percentage as well as tactics and procedures. A platoon must hit 70 % of the aggregate targets and receive a rating of T or P on 70 % of tactical tasks in order to achieve Table XII qualification.

Achieving Table XII qualification is a unique objective of the SIMITAR training strategy. Accordingly, Table XII was not fired by comparison units during the 1993-1997 time period.

#### *Gunnery Training Assessment Database*

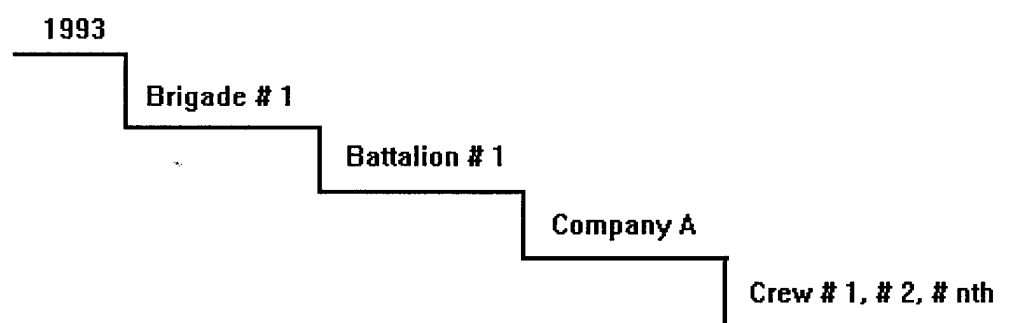
Central to the present research was development of a database for assessing the impact of gunnery training (Smith, in publication). This database supports the tracking of historical variables concerning the use of TADSS, gunnery training and qualification data associated with this use, live-fire gunnery performance measures, and other measures essential for assessing the impact of different gunnery training interventions/strategies adopted by ARNG armor and mechanized infantry units. The database contains gunnery measures for the test SIMITAR brigade as well as for the 6 non-SIMITAR enhanced comparison brigades.

Pursuant to contract specifications, the gunnery database is configured within a software program known as the Statistical Package for the Social Sciences (SPSS), version 6.1 for Windows. SPSS (Norusis, 1993; SPSS, 1993; SPSS, 1994) provides a wide array of data examination and statistical manipulation operations which can be applied to information in the database. These operations range from simple frequency tabulations to complex multivariate routines such as factor analysis and clustering algorithms. Using SPSS, it is possible to re-code existing variables, create new variables by combining old ones, weight selected variables, add new variables, remove old variables, insert new cases or remove old ones, select subsets of the database for statistical analysis, and perform a virtually unlimited variety of operations, including the creation of tables, charts, graphs, and scatter plots.

SPSS version 6.1 files can be exported in a number of formats, permitting their incorporation into a variety of spreadsheet and database management programs, as well as several other statistical utilities. Export capabilities include ASCII (\*.dat), SPSS Portable Files (\*.por), Excel (\*.xls), Lotus 1-2-3 Rel 3.0 (\*.wk3) and earlier Lotus 1-2-3 releases, SYLK (\*.slk), dBASE IV (\*.dbf) and earlier dBASE releases, as well as formats compatible with earlier PC-based versions of SPSS, such as SPSS/PC+ (\*.sys). Of all these export formats, ASCII is the most generic. (ASCII stands for American Standard Code for Information Interchange.) ASCII export files permit SPSS data to be imported into virtually any text-based program, including most alternative statistical programs. Using a Windows graphical interface, SPSS output also can be copied and pasted into most word processing programs.

The basic hierarchical structure of the database is shown in Table 5. Year of data generation is the first level of organization. The oldest data (from 1993) appear first in the database and

Table 5  
*Basic Structure of the Database*



repetitions of all subsequent levels of organization occur before any data from 1994 appear. Crews function as the most basic level of organization. Each row in the database contains data for a single crew (either an Abrams main battle tank crew or a BFV crew). All crews within Company A appear before any Company B crews. All companies within Battalion # 1 appear



before any Battalion # 2 companies. And all battalions within Brigade # 1 appear before any Brigade # 2 battalions.

Within each year, data from the test brigade appears first, and is followed by the non-SIMITAR comparison brigades, arranged in alphabetical order based on the state in which they are located (Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Washington). Within brigades, armor battalions always appear first, followed by mechanized infantry battalions and cavalry troops. The specific order of battalions within brigades is the same as the order of battalions listed above under the section heading "Comparison Brigades."

Within battalions, companies appear in alphabetical order (A, B, C, etc.) Within companies, crews are arranged numerically based on vehicle bumper number. Bumper numbers also reveal how tanks and BFVs are assigned to platoons. Bumper numbers appear in clusters of 4 (e.g., 11, 12, 13, 14, 21, 22, 23, 24). Four vehicles constitute a platoon, and platoons are formed from consecutive numbers. (E.g., 11, 12, 13, and 14 would constitute a platoon.) Names and crew positions of individual crew members are included in the database when that information was available.

For clarity, the numeric identification variables (year, brigade, battalion, company, and crew number) are accompanied by several string (alphanumeric) variables. Immediately following the "Brigade" variable, database users will find another variable, called "Bdename," which provides the brigade's verbal designation. Following the "Battlion" variable, another string variable identifies the particular battalion. Following the "Tank#" variable, a string variable called "Roster" gives the name and position of each member of the crew, when this information was available. (Tanks have four crew members: commander, gunner, loader, and driver. BFVs have three crew members: commander, gunner, and driver.) The full structure of the database, as well as a dictionary defining all of its variables, can be found in the accompanying User's Manual (Smith, in publication).

### *Organization of Measures Within the Database*

The first ten variables in the database (Year, Brigade, Bdename, Armech, Battalion, Battname, Company, Crew#, Tank#, and Roster) are illustrated in Table 6 for the first 10 crews from Company A of the first unit in the database (2-116th AR) for the year 1993. This table is for illustration purposes only. The actual database contains many more variables (in the form of other columns which would extend beyond the right-hand margin of Table 6) and many more cases (in the form of other rows which would extend beyond the bottom row of Table 6).

Table 6  
*The First 10 Variables in the Gunnery Database*

Yr	Bde	Bdename	Armech	Bn	Battname	Co	Crew#	Tank#	Roster
93	1	116 Cavalry Bde	1	1	2-116 AR	A	1	A11	Pete Turner, TC;
93	1	116 Cavalry Bde	1	1	2-116 AR	A	2	A12	W.O. Goodman, TC;
93	1	116 Cavalry Bde	1	1	2-116 AR	A	3	A13	Henry Bowman, TC;
93	1	116 Cavalry Bde	1	1	2-116 AR	A	4	A14	Carlton Stowers, TC;
93	1	116 Cavalry Bde	1	1	2-116 AR	A	5	A21	Conley Bartlett, TC;
93	1	116 Cavalry Bde	1	1	2-116 AR	A	6	A22	J.B. Swift, TC;
93	1	116 Cavalry Bde	1	1	2-116 AR	A	7	A23	Elmore Lankston, TC;
93	1	116 Cavalry Bde	1	1	2-116 AR	A	8	A24	Clint Tucker, TC;
93	1	116 Cavalry Bde	1	1	2-116 AR	A	9	A34	James Petersen, TC;
93	1	116 Cavalry Bde	1	1	2-116 AR	A	10	A66	Gene Benchley, TC;

Each column in Table 6 represents a different variable. Names of variables appear in the first row of the table. Each subsequent row contains the data for a different crew. Notice that the string variable “Roster” does not display in its entirety in Table 6. This would also be the case if a database user opened the main data file on a computer and examined this variable on a monitor screen. The Roster variable consists of 100 characters, enough space to record the names and positions of all crew members, but all 100 characters are not ordinarily displayed. This field, for crew #1 in Table 6, actually contains the following information: “Pete Turner, TC; Bonney, Gnr; York, Ldr; Andretti, Dvr.” If the entire variable field were printed out, however, it would stretch across most of the available SPSS screen and make it difficult to identify variables that come before and after it in the database. SPSS normally reveals only enough of a long alphanumeric variable to identify its content (the first crew member in this instance, which happens to be the vehicle commander). If a database user desires full details on a crew’s composition, however, he or she can move the cursor to any cell (i.e., row) under the “Roster” variable, click the mouse on the cell, and view a full listing of all crew members and their crew positions in the edit box at the top of the SPSS screen. Similarly, printouts of crew member names can be obtained for any desired subset of the database using the “Statistics” and “List Cases” SPSS main menu items.

As mentioned previously, there are more variables in the gunnery database than shown in Table 6. The additional variables, if they had been printed, would have appeared to the right of the last variable (“Roster”). Table 7 illustrates the next nine variables in the database. These measures belong to the same 10 crews listed in Table 6. All variables in Table 7 are concerned with tank Table VIII, the standard measure of crew-level tank gunnery proficiency. (BFV Table VIII data are recorded in separate columns [farther to the right] in the database.)

Table 7  
*The Next 9 Variables in the Gunnery Database*

T8A1	RoundsA1	HitsA1	T8A2	RoundsA2	HitsA2	T8A3	RoundsA3	HitsA3
54	3	2	77	4	2	100	0	0
100	2	2	100	4	2	65	0	0
100	2	2	82	2	2	100	0	0
0	2	0	100	4	2	83	0	0
0	3	1	2	3	1	75	0	0
100	2	2	88	3	2	0	0	0
74	2	2	100	3	2	74	0	0
95	2	2	16	1	1	42	0	0
69	2	2	87	3	2	42	0	0
12	1	1	32	3	1	0	0	0

Table VIII scoresheets provide a number of quantitative outcome measures, including engagement scores, total scores, the proportion of crews qualifying, the proportion of crews attaining first-round qualification, the number of main-gun rounds fired, and the number of targets hit. The first variable listed (T8A1) in Table 7 is the score obtained on engagement A1 from Table VIII. The first tank crew in Table 7 scored 54 on engagement A1; the second crew scored 100, and so on. Definitions of any variable can be obtained while working in the database by clicking on the variable's name in the top row of Table 7, thereby causing the entire column to be highlighted, choosing "Data" from the SPSS main menu at the top of the screen, and then "Define Variables – Labels" from the resulting drop down menu. The same information can be obtained from the data dictionary appendix contained in the User's Manual (Smith, in publication).

The next two variables in Table 7, "RoundsA1" and "HitsA1," are part of a rounds-fired and hits-recorded analysis (first-run data only). On the first engagement (T8A1), for example, which contains two targets, the first crew listed in Table 7 fired three main-gun rounds and had two hits. The second crew fired two rounds and had two hits. Notice that a perfect score (i.e., 100) on this engagement requires that both targets be hit. Moreover, the targets must be hit within a prescribed time limit in order to obtain the maximum score without incurring a penalty (U.S. Army Armor Center, 1993). Some crews in Table 7 have destroyed both targets, yet received less than a perfect score, either from taking too much time or otherwise incurring procedural penalties (i.e., "crew cuts"). Crews hitting 0 or 1 target invariably received low scores. The rounds-fired and hits-recorded (first-run only) data were taken from official Table VIII

scoresheets filled out on the range by certified tank crew evaluators. A similar rounds-fired and hits-recorded (first-run only) analysis was performed for each subsequent Table VIII engagement.

Rounds-fired and hits-recorded data in Table 7 are for main gun ammunition only. Notice that regardless of score on the third Table VIII engagement (T8A3), zero rounds-fired and hits-recorded appear in the next two columns. That is because engagement A3 of Table VIII is a machine gun engagement.

After all the measures for individual engagements are entered, other scores for Table VIII appear in the database, including Table VIII total score, rounds fired during the first-run qualification attempt, whether qualification was achieved during the first-run attempt, whether qualification was eventually achieved if it did not occur during the first-run attempt, and the total number of additional rounds required in order to achieve qualification if it was not achieved during the first-run attempt.

After tank Table VIII variables, the database contains columns for corresponding values for the BFV crews. Because of a change in scoring procedure, many of these fields are blank in 1997 because the new scoring procedure produces only trained (T), needs practice (P), and untrained (U) ratings on each engagement, instead of quantitative scores.

#### *Analytic and Design Provisos*

The basic question to be addressed in the results section below is whether test battalions exhibited training outcomes that were attributable to the SIMITAR training strategy interventions. To the extent permitted by the data, this question can be examined in four ways: (1) Was the implementation of the SIMITAR strategy accompanied by changes in training outcome among test battalions? (2) Did changes in training outcome also occur among comparison battalions during the same time period? Changes in test battalions, but not in comparison battalions, would support an interpretation that the SIMITAR strategy produced the observed effect. This interpretation would be undermined, however, if corresponding changes also occurred in comparison battalions, or if changes occurred in comparison battalions but not in test battalions. (3) Were test and comparison battalions comparable on key measures of training outcome before the implementation of the SIMITAR strategy? (4) Were test and comparison battalions comparable after the SIMITAR intervention? Although pre-intervention equivalence is not mandatory, an outcome pattern consisting of comparability before the intervention and non-comparability afterwards would support the conclusion that the SIMITAR strategy caused the observed change.

A number of training outcome measures from the database were examined in order to address these questions. These measures included percentage of crews achieving first-run Table VIII

qualification, percentage of crews achieving eventual qualification, total number of main gun rounds fired in order to achieve qualification, Table VIII total score achieved during first-run qualification attempts, and percentage of platoons or companies attempting or passing Table XII.

Two analytic techniques were used: analysis of variance (ANOVA) for continuous variables and chi square for dichotomous measures. First-run Table VIII scores, for example, were analyzed using a one-way ANOVA (between-groups) to determine if mean scores differed between test and comparison units. ANOVAS were also used to test for differences among test units from before the SIMITAR strategy to after its implementation. This pre-post analysis did not fully qualify as either a between-Ss or as a repeated measures (within-Ss) ANOVA model. If crews had remained intact from the beginning to the end of the data collection period (i.e., from 1993 until 1997), a repeated measures model could have been used to test for pre- versus post-SIMITAR effects. But a check of the data indicated that crew continuity rarely extended beyond adjacent years. Therefore, a repeated measures model for the pre-SIMITAR versus SIMITAR time period factor was not appropriate.

On the other hand, although there was substantial crew turnover, it wasn't complete. Some personnel remained in the units throughout the duration of the investigation, and even though they might have been teamed with different crew members every year, their data could not be assumed to be independent from one year to the next. Therefore, a between-Ss model was not strictly applicable for the pre-SIMITAR versus SIMITAR time period factor either.

Neither was it possible to base an analysis only on crews meeting the assumptions of one or the other ANOVA models. Using only crews that remained intact from 1993 to 1997 would have reduced the working  $n$  to near-zero. Conversely, using only crews with no commonality of crew membership over the four pairs of adjacent years (1993-1994, 1994-1995, 1995-1996, and 1996-1997) would also have severely reduced the working  $n$ .

Thus, neither the between-Ss nor the repeated measures model was strictly applicable in the current context. Of the two, repeated measures was most clearly inappropriate. Use of this model would have required that crews remain intact from 1993 to 1997, and that clearly did not happen. In contrast, the between-Ss model assumes uncorrelated error terms and that assumption also was violated to some extent because some personnel were involved in multiple years of the investigation. However, the between-Ss ANOVA model is known to be robust in the face of a broad range of affronts to its underlying assumptions (Winer, 1967). In this instance, it is also the more conservative analytic approach. Accordingly, it was employed with the full awareness that it is not strictly appropriate for comparing pre-SIMITAR test crews with SIMITAR-period test crews.

The same concerns and limitations regarding the applicability of between-Ss versus repeated measures ANOVA models also pertained to dichotomous measures, such as Table VIII

qualification versus nonqualification. The standard chi square test (Hays, 1963) assumes that observations are independent. This assumption is fully met when comparing SIMITAR and non-SIMITAR units within any given time period, but not when comparing SIMITAR (or non-SIMITAR) units from one year to another. (*Some* but not *all* crews were intact across years.) Repeated measures chi square tests have been developed, but they would be applicable only in situations where all crews were intact across all the years involved in the test. As discussed above, this circumstance was rarely met. Accordingly, standard (Pearson) chi square tests were used to test dichotomous variables (consistent with the use of between-Ss ANOVAs for continuous data measures), although they were not strictly applicable for some comparisons.

For example, qualification versus nonqualification was crossed with test versus comparison treatment condition to form 2 x 2 tables of the 4 possible outcomes (test condition and qualified, test condition and not qualified, comparison condition and qualified, and comparison condition and not qualified). Dichotomous variables were also examined within treatment conditions (test and comparison) to determine if outcome was independent of time period. This approach also formed four possible outcomes: pre-SIMITAR period and qualified, pre-SIMITAR period and not qualified, SIMITAR period and qualified, and SIMITAR period and not qualified.

In both chi square and ANOVA tests, the usual procedure was to combine data from 1993 and 1994 to form a pre-SIMITAR time period and data from 1995 to 1997 to form a SIMITAR time period. Exceptions to this general analytic procedure were made only if presentation of data from individual years facilitated the interpretation of ambiguous outcomes. In all statistical tests, the rejection region was set = .05. In all chi square tests degrees of freedom = 1. Accordingly, *p* levels for all statistical tests and degrees of freedom relating to chi square tests are omitted from all subsequent statistical text.

## Results

### *Tank Table VIII First-Run Qualification (Q1)*

Table 8 shows the proportion of tank crews in test and comparison brigades that attained first-run Table VIII qualification (Q1) during pre-SIMITAR years (1993-1994) and during SIMITAR years (1995-1997). The proportion of qualifying crews decreased in both test and comparison units across this time interval. Chi square tests indicated that among test units the proportion of crews attaining Q1 qualification significantly decreased,  $\chi^2 = 10.28$ , from the pre-SIMITAR to the SIMITAR time period. The apparent decrease in Q1 qualification rates among comparison units, however, was not significant.

Table 8

*First-Run Qualification (Q1) Among Tank Crews*

Time Period	Test Brigade		Comparison Brigades	
	% Q1 <sup>a</sup>	<i>n</i>	% Q1 <sup>a</sup>	<i>n</i>
Pre-SIMITAR (1993-1994)	43.7	126	56.3	160
SIMITAR Years (1995-1997)	27.0	230	48.9	540

<sup>a</sup> % Q1 = proportion of crews achieving Table VIII qualification on their first-run, e.g., 55 test crews in the pre-SIMITAR period (43.7% of 126 crews) achieved first-run qualification.

Chi square tests were also conducted between test and comparison units within each time period. In both instances, Q1 rates were significantly higher in the comparison brigades than in the test brigade,  $\chi^2 = 4.48$  and  $\chi^2 = 31.78$ , for pre-SIMITAR and SIMITAR time periods, respectively.

*Tank Table VIII Eventual Qualification (Qn)*

Table 9 shows the proportion of tank crews in test and comparison brigades that attained eventual Table VIII qualification (Qn) during both pre-SIMITAR (1993-1994) and SIMITAR

Table 9

*Tank Table VIII Eventual Qualification (Qn)*

Time Period	Test Brigade		Comparison Brigades	
	% Qn <sup>a</sup>	<i>n</i>	% Qn <sup>a</sup>	<i>n</i>
Pre-SIMITAR (1993-1994)	96.0	126	90.6	160
SIMITAR Years (1995-1997)	94.3	230	92.8	540

<sup>a</sup> % Qn = proportion of crews eventually achieving Table VIII qualification, e.g., 121 test crews in the pre-SIMITAR period (96.0% of 126 crews) eventually qualified.

(1995-1997) time periods. Qn qualification rates did not differ significantly between pre-SIMITAR and SIMITAR time periods within either test or comparison brigades.

In both pre-SIMITAR and SIMITAR time periods, Qn among test units was slightly higher numerically than among comparison units. But for neither time period were the differences significant.

#### *Tank Table VIII First-Run Scores*

First-run Table VIII scores from test and comparison units could not be compared during the years 1993-1995. This was because comparison unit Table VIII rollups did not include first-run scores of crews that required more than one run to qualify. For these crews, only their eventual Table VIII score was provided. This score, of course, did not reflect their first-run performance. It was possible, however, to examine test unit first-run Table VIII scores for 1993-1997, and comparison unit scores for 1996-1997.

Table 10 presents first-run Table VIII mean scores for test and comparison units. Only one significance test was possible between test and comparison units and that was within the SIMITAR time period. These means, differing by some 41 points, were significantly different,  $F(1, 555) = 5.99$ . Means within the test brigade from pre-SIMITAR to SIMITAR years also differed significantly,  $F(1, 354) = 24.85$ . The mean decrease in first-run Table VIII scores among test unit crews is consistent with the significant reduction in proportion of crews attaining Q1 qualification (see Table 8).

Table 10

#### *Tank Table VIII Mean First-Run Scores*

Time Period	Test Brigade		Comparison Brigades <sup>a</sup>	
	Mean	<i>n</i>	Mean	<i>n</i>
Pre-SIMITAR (1993-1994)	654.9	126	na	na
SIMITAR (1995-1997)	552.7	230	593.9	327

<sup>a</sup> Comparison data were available for only 2 of the 3 (1996-1997) SIMITAR years.  
na = data not available

Table 11 presents mean first-run Table VIII scores by individual year for test and comparison units, in order to determine if the decrease among test unit scores from pre-SIMITAR to SIMITAR occurred abruptly with the onset of the training strategy intervention, or if it was more gradual. Within the test units, a one-way ANOVA showed a significant effect for year,  $F(4, 351) = 8.39$ , a significant linear trend component,  $F(1, 351) = 22.7$ , and a significant deviation from linear trend component,  $F(3, 351) = 4.64$ . A visual examination of Table 11 shows that test brigade means began at a relatively high level and gradually decreased until 1996, which



served as a bottom. In 1997, scores rebounded substantially in the test units. A Student-Newman-Keuls pair-wise comparison test revealed that the mean for 1993 differed significantly from 1995, 1996, and 1997 means. Moreover, means for both 1994 and 1997 differed from the 1996 mean, statistically substantiating the apparent “bottom” and subsequent “rebound.”

Table 11

*Tank Table VIII Mean First-Run Scores By Year*

Year	Test Brigade		Comparison Brigades <sup>a</sup>	
	Mean	<i>n</i>	Mean	<i>n</i>
1993	670.4	57	na	na
1994	642.1	69	na	na
1995	578.8	59	na	na
1996	505.7	77	653.5	194
1997	574.8	94	506.9	133

<sup>a</sup> na = data not available.

Only two years of first-run Table VIII data were available from comparison units. The comparison brigade mean score decreased a significant amount between 1996 to 1997,  $F(1, 325) = 48.79$ . Moreover, the comparison unit mean significantly exceeded the test unit mean in 1996,  $F(1, 269) = 32.31$ , but a year later the test unit mean significantly exceeded the comparison unit mean,  $F(1, 225) = 7.57$ .

*Tank Table VIII Rounds Analysis*

The availability of Table VIII scoresheets from test armor battalions for the years 1993 through 1997 and from (some) comparison battalions for the years 1996 and 1997 permitted an examination of the number of tank main gun rounds expended on Table VIII qualification attempts. Rounds were summed across all engagements fired in pursuit of Table VIII qualification. Total rounds data are presented in Table 12.

The slight increase in main gun rounds among test units from pre-SIMITAR to SIMITAR years was not significant. Within the SIMITAR time period, test and comparison means did not differ. Thus, SIMITAR seemed to have no impact on overall ammunition consumption.

Table 12

*Tank Table VIII Total Main Gun Rounds*

Time Period	Test Brigade		Comparison Brigades	
	Mean	<i>n</i>	Mean	<i>n</i>
Pre-SIMITAR (1993-1994)	20.8	120	na <sup>a</sup>	na
SIMITAR (1995-1997)	21.6	228	21.1	200

<sup>a</sup> na = data not available.

*BFV Table VIII First-Run Qualification (Q1)*

Table 13 shows the proportion of BFV crews in test and comparison units that attained first-run (Q1) qualification. Among comparison units, the proportion of crews attaining Q1 qualification decreased significantly from pre-SIMITAR to SIMITAR time periods,  $\chi^2 = 9.93$ . (A similar test could not be conducted among test crews due to the lack of data prior to 1997.) Within the SIMITAR time period, Q1 rates differed significantly between test and comparison units,  $\chi^2 = 50.2$ , with comparison units achieving a higher first-run qualification percentage than that of the test unit.

Table 13

*BFV Crew First-Run Qualification (Q1)*

Time Period	Test Brigade		Comparison Brigades	
	% Q1 <sup>b</sup>	<i>n</i>	% Q1 <sup>b</sup>	<i>n</i>
Pre-SIMITAR (1993-1994)	na <sup>a</sup>	na	73.1	212
SIMITAR (1995-1997)	8.3	48	61.0	582

<sup>a</sup> na = data not available.

<sup>b</sup> % Q1 = proportion of crews achieving Table VIII qualification on their first-run, e.g., 4 test crews in the SIMITAR period, (8.3% of 48 crews) achieved first-run qualification.

### *BFV Table VIII Eventual Qualification (Qn)*

Table 14 shows the proportion of BFV crews in test and comparison units that eventually attained qualification (Qn), regardless of the number of trial runs. Qualification rates among comparison units did not differ across the two time periods. (A similar test could not be conducted among test crews due to the lack of data prior to 1997.) Within the SIMITAR time period, Qn rates differed significantly between test and comparison units,  $\chi^2 = 30.6$ , showing that the rate of qualification was higher in the comparison units.

Table 14  
*BFV Table VIII Eventual Qualification (Qn)*

Time Period	Test Brigade		Comparison Brigades	
	% Qn <sup>a</sup>	<i>n</i>	% Qn <sup>a</sup>	<i>n</i>
Pre-SIMITAR (1993-1994)	na <sup>b</sup>	na	88.2	212
SIMITAR (1995-1997)	66.7	48	91.8	582

<sup>a</sup> % Qn = proportion of crews eventually achieving Table VIII qualification, e.g., 187 comparison crews in the pre-SIMITAR period, (88.2% of 212 crews) eventually qualified.

<sup>b</sup> na = data not available.

### *BFV Table VIII First-Run Scores*

BFV Table VIII scores provided by comparison brigades from 1993-1995 did not include first-run scores for crews failing to Q1 but eventually qualifying. In the absence of first-run scores for the less successful crews, first-run scores calculated on these data would be misleading. Resulting means would be artificially inflated. Interpretable data were available for 1996 from comparison brigades, but unfortunately the test BFV battalion was still in NET that year and did not fire Table VIII. In 1997, BFV Table VIII scoring procedures were changed, eliminating the traditional 0 to 1,000 scoring procedure.

### *Table XII Scores*

Attainment of platoon-level gunnery qualification within the limited time constraints of the traditional RC training calendar is one of the primary goals of the SIMITAR strategy. Table XII is the traditional measure of platoon-level gunnery proficiency. This section reviews the extent to which units of the test brigade achieved platoon-level gunnery proficiency objectives as

measured by Table XII performance. (Table XII was not fired by comparison brigade units in the 1993-1997 time interval.)

Although implementation of the SIMITAR strategy did not begin officially until 1995, the test brigade was anticipating the program as much as a year earlier. Beginning in 1994, platoons in both armor battalions of the test brigade shot a modified Table XII during AT. In 1994 the table was modified to include only daylight defensive scenarios. Another modified Table XII (day and night defensive scenarios) was fired by the armor units in 1995. In 1996, armor units fired Table XII as part of a Combined Arms Live-Fire Exercise (CALFEX), using day and night offensive and defensive scenarios. Training year 1997 saw implementation of a full-up Table XII among both armor battalions and the mechanized infantry battalion.

Table XII results are summarized in Tables 15-18 for training years 1994-1997, respectively. In these tables, blank cells signify that either no crews existed, or insufficient crews existed to form a platoon. On the other hand, if a platoon existed but for any reason failed to fire Table XII, that fact is noted by a "did not fire" (dnf) entry. In all instances, crew counts were based on Table VIII qualifications. These tables also reveal the chronic state of under-staffing in these units during the 1994-1997 time interval. In many instances, companies were composed of only 2 fully staffed platoons, instead of the 3 platoons normally assigned to a company.

For 2-116 AR in 1994 (see Table 15), 8 platoons attempted the modified Table XII and 4 of the 8 (50 %) achieved qualification. For all 8 platoons combined, mean gunnery, tactical, and

Table 15

*1994 modified Table XII scores for the 2-116 AR Test Battalion*

Training Year 1994: 2-116 AR				
Company	Platoon	Gunnery	Tactical	Total
A	1	67	96	82
	2	76	100	88
B	1	52	68	60
	2	64	76	70
	3	77	72	75
D	1	77	88	83
	2	59	96	78
	3	75	88	82

total scores were 68, 86, and 77, respectively. For 3-116 AR, modified Table XII scores in the form of either scoresheets or rollups were unavailable. Conversations with battalion representatives, however, revealed that 3 of the 4 (75%) fully staffed platoons that attempted Table XII successfully qualified.

In 1995 (see Table 16), 6 platoons from 2-116 AR attempted the modified Table XII and 4 of the 6 (66.7 %) qualified. For all 6 platoons combined, mean gunnery, tactical, and total scores were 70, 94, and 82, respectively. For 3-116 AR, breakouts for separate modified Table XII gunnery and tactical components were not available. Table 16 summarizes available total scores, and shows that 5 of 6 possible platoons attempted the modified Table XII and 3 of the 5 (60 %) successfully qualified. For all 5 platoons combined, the mean total score was 74.

Table 16  
*1995 modified Table XII scores for the SIMITAR Test Brigade*

Training Year 1995					
		2-116 AR <sup>a</sup>			3-116 AR <sup>a, b</sup>
Company	Platoon	Gunnery	Tactical	Total	Total
A	1	72	96	84	82
	2	76	93	85	73
B	1	67	93	80	65
	2	73	100	87	87
D	1	72	93	83	dnf
	2	58	86	72	
E	1				64

<sup>a</sup> Blank cells indicate either no crews or insufficient crews to form a platoon.

<sup>b</sup> dnf = a platoon existed but did not fire Table XII.

In 1996 (see Table 17), the SIMITAR test brigade switched to a company-level scoring protocol for its modified Table XII. For 2-116 AR, 100 % qualification was achieved. For all 4 companies combined, mean gunnery, tactical, and total scores were 74, 86, and 81, respectively.

Table 17  
*1996 modified Table XII scores for the 2-116 Test Battalion*

Training Year 1996: 2-116 AR				
Company	Platoon <sup>a</sup>	Gunnery	Tactical	Total
A	na	75	100	88
B	na	77	72	75
C	na	75	100	88
D	na	70	71	71
E	na			

*Note.* Blank cells indicate either no crews or insufficient crews to form a platoon.

<sup>a</sup>na = not applicable; Table XII was scored at the company level.

For 3-116 AR, modified Table XII scores were unavailable. Conversations with battalion representatives, however, revealed that 3 of 4 (75 %) companies that attempted the modified Table XII successfully qualified.

In 1997 (see Table 18), the SIMITAR test brigade changed back to a platoon-level Table XII scoring protocol. For 2-116 AR, 7 platoons attempted Table XII and 0 out of 7 (0 %) qualified.

Table 18  
*1997 Table XII scores for the SIMITAR Test Brigade*

Training Year 1997							
		2-116 AR <sup>a</sup>			3-116 AR <sup>b</sup>		
Co.	Platoon	Gunnery	Tactical	Total	Gunnery	Tactical	Total
A	1	45	77	61	33	100	67
	2	63	100	82	51	100	76
B	1	39	90	65	51	100	76
	2	27	100	64	61	100	81
C	1	41	100	71	47	100	74
	2	38	96	67	54	83	69
D	1	37	90	64	55	100	78
	2				37	97	67
E	1				dnf	dnf	dnf

<sup>a</sup> Blank cells indicate either no crews or insufficient crews to form a platoon.

<sup>b</sup> dnf = a platoon existed but did not fire Table XII.

For all 7 platoons combined, mean gunnery, tactical, and total scores were 41, 93, and 68, respectively. For 3-116 AR, 8 of 9 eligible platoons attempted Table XII and 0 out of 8 achieved qualification. For all 8 platoons combined, mean gunnery, tactical, and total scores were 49, 98, and 74, respectively.

In both armor battalions, tactical scores were uniformly high (9 of 15 platoons received perfect ratings). In every case, the problem with failing to qualify occurred on the Table XII gunnery component. According to firsthand reports, only about 75% of tanks were able to execute fire commands during the exercise.

Not represented in Table 18 are 2 tank platoons from G/82 CAV (Oregon) and 8 BFV platoons from 1-163 IN (Montana). These units appeared in the database for the first time during the 1997 training year. For the two G/82 CAV platoons, the mean gunnery, tactical, and total Table XII scores were 43, 100, and 72, respectively. Neither CAV platoon achieved Table XII qualification, because of the depressed gunnery component scores. In the 1-163, 6 of 8 platoons

fired Table XII, and all 6 that fired received either P or T ratings on both gunnery and maneuver components. Two of 6 platoons that fired Table XII successfully qualified.

Table 19 summarizes Table XII data for 1994-1997. From the “% Attempted” columns, it can be calculated that beginning in 1994 for the two armor battalions and in 1997 for the mechanized infantry unit and the CAV troop, 94% of all fully staffed platoons/companies in the test brigade attempted Table XII qualification. Among units that attempted Table XII qualification, the success rate was 45%. The overall rate was substantially depressed by the failure to qualify any armor crews in 1997. Excluding these uncharacteristic outcomes, the overall qualification rate was 65%.

Table 19  
*Summary of Table XII Results for the SIMITAR Test Brigade*

	2-116 AR		3-116 AR		1-163 IN <sup>a</sup>		G/82 CAV <sup>b</sup>	
Year <sup>c</sup>	% Attempted	% Qualified	% Attempted	% Qualified	% Attempted	% Qualified	% Attempted	% Qualified
1994	100	50	100	75				
1995	100	67	83	60				
1996	100	100	100	75				
1997	100	0	89	0	100	25	100	0

<sup>a</sup> The 1-163 was not formed until 1995 and the battalion was in NET until the 1997 training year.

<sup>b</sup> The G/82 CAV did not fire Table VIII or Table XII until 1997.

<sup>c</sup> Modified Table XIIs were shot in 1994-1996.

## Discussion

### *Table VIII Qualification*

During gunnery training years, ARNG armor and mechanized infantry units using conventional training methods aspire to achieve crew-level Table VIII qualification by the conclusion of AT. The SIMITAR test brigade observed as part of this investigation, however, attempted to go beyond crew-level gunnery proficiency. By taking full advantage of available TADSS technologies, and through implementation of the SIMITAR compressed gunnery training strategy, the test brigade sought to achieve both crew-level gunnery qualification on Table VIII and platoon-level gunnery qualification on Table XII, all within the same limited training window that is available to all ARNG units (i.e., 39 training days). In order to accomplish both crew-level and platoon-level objectives, SIMITAR units set the goal of achieving Table VIII qualification either early in AT or, more commonly, as part of IDT prior to AT

SIMITAR compressed gunnery training strategy implementation resulted in almost total attainment of the first objective, early Table VIII qualification. From the inception of the strategy, both armor units of the test brigade consistently arrived at AT either with Table VIII qualifications already accomplished (during IDT), or with qualifications scheduled during the first three days of AT. By 1997, the test brigade's armor battalions had been joined by its mechanized infantry and CAV units in this state of advanced Table VIII training readiness, freeing up the bulk of scheduled AT time for platoon- and higher-level tactical training.

#### *Table XII Qualification*

Across a four-year period (1994-1997), moreover, 94 % of test brigade platoons were sufficiently trained to attempt Table XII qualification (and had the time to do so) at some point during AT. Because of the increased complexity of platoon, company, and battalion tactical training objectives, attaining a state of training readiness sufficient to stage realistic attempts at Table XII qualification is an accomplishment in itself. Additionally, almost half of these platoons successfully qualified on Table XII, and the qualification rate prior to 1997 was 67%. Of course, the Table XIIs attempted by SIMITAR test units were not "full-up" versions until 1997. Modified versions were attempted in earlier years.

The uncharacteristically low Table XII qualification rate in 1997 (i.e., 0 %) was attributed to two principal factors. First, it was the first year that a full (unmodified) Table XII was fired. Second, approximately 1 crew in 4 failed to engage gunnery targets during the Table XII exercise. It will be recalled that Table XII qualification requires hits on a minimum of 70% of all gunnery targets. The 3 tanks out of 4 that fired needed almost 100% accuracy in order to achieve this criterion. This means that platoon qualification was not impossible, but it was highly improbable in 1997.

Table XII qualification for the test brigade during 1997 AT was complicated by operational and scheduling problems as well. SIMNET was inoperative, so the expected Table XI and Table XII simulation rehearsals were unavailable. Because these crews had completed Table VIII qualification 30 to 60 days previously during IDT, they were scheduled for Table XII qualification early in AT. For many crews, their first AT main gun rounds were on Table XII.

Facing Table XII qualification without rehearsal was a tough assignment. Table XII is a complicated and challenging exercise. Even under the best of circumstances, satisfactory Table XII performance by ARNG units will not be easy. Several trials may be required before the table can be mastered. The indisputable legacy of SIMITAR, however, is that the process has now been started. Crews and leaders of the SIMITAR test brigade now have a new training standard that includes both crew- and platoon-level gunnery proficiency as well as platoon-, company-, and battalion-level maneuver training. (The Institute for Defense Analyses [IDA]) is currently preparing an assessment of the test unit's maneuver proficiency.)



### *Table VIII Q1 Scores*

As work on attaining Table XII proficiency continues, it is important to monitor other measures of training readiness to ensure that the underlying skills don't deteriorate. One of these areas is crew-level gunnery proficiency as measured by Table VIII performance. In the present investigation, success on tactical training objectives and on Table XII qualification occurred without sacrifice of crew-level gunnery skills, at least as measured by eventual qualification on Table VIII. Eventual Table VIII qualification in the test unit hovered around 95% both before and after implementation of the SIMITAR training strategy. These rates were statistically comparable to Table VIII qualification levels observed among comparison units, which ranged from 91% to 93%.

On the other hand, first-run Table VIII qualification rates (Q1) deteriorated during SIMITAR strategy implementation, and future performance on this measure deserves heightened watchfulness. The deterioration occurred both in proportion of crews achieving Table VIII Q1, as well as in mean Table VIII first-run scores. Some of this deterioration may have resulted because test units often carried the compression strategy beyond the dictates of the SIMITAR strategy (see Shaler, 1995). By compressing gunnery training to the point that most test units completed Table VIII qualification before AT began, it may be that too much training was compressed into too little time and that consequently not enough time was allotted to traditional crew-level gunnery training. If the IDT training schedule is full to begin with and then Table VIII qualification is superimposed on top of everything else, it is only a commonsense observation that performance levels on some tasks will be degraded. Training representatives reported that by moving Table VIII into the IDT training schedule, it was often Table V and Table VI exercises (see Table 1, training periods #4 and #6) that received reduced attention. It is possible that the observed deterioration in Table VIII Q1 rates and in Table VIII first-run mean scores would not have occurred, or would have occurred to a lesser extent, if the SIMITAR strategy had been implemented strictly according to plan (see Shaler, 1995).

Another factor that may have contributed to the observed downtrend in Table VIII gunnery scores was the increased emphasis on battle staff and CSS training. It will be recalled from the introduction that SIMITAR consists of a three-tiered training strategy. Only the second tier (which has been the concern of this report) focuses on gunnery-related small unit collective training. The first and third tiers are concerned with battle staff and CSS training, respectively. It is noteworthy that all three training tiers were implemented in the SIMITAR test brigade, and that the mastery of each tier of training activities requires substantial time and effort. This was especially the case for the first tier, which consists of battlefield synchronization training at the battalion and brigade level, achieved through JANUS simulation delivered to commanders and staff officers at their home-station armories. SIMITAR battalions were expected to perform a task force exercise once per quarter, and these exercises involved personnel down to platoon

leaders and sergeants. Additionally, brigade exercises were conducted at least twice annually. Although it is not possible to make cause-effect statements concerning the relationship between increased battle staff training activities and the observed downward trend on Table VIII scores, it is well known that RC units operate under stringent training time constraints (Eisley & Viner, 1989). Compared to active component (AC) units, RC units have fewer than 20% of the annual days available for training. With only 39 annual training days available, it is not unrealistic to expect that enhanced emphasis in one area may be accompanied by reduced emphasis in other areas.

Nonetheless, it is also possible that something unrelated to SIMITAR may have caused the observed deterioration and that it would have taken place with or without the SIMITAR implementation. In support of this argument, it is well to note that some deterioration also occurred in comparison units, and this impact was outside the realm of possible SIMITAR influence. Performance deterioration in comparison units was manifest (although nonsignificantly) in a decreased proportion of armor crews achieving Q1, as well as (and to a statistically reliable extent) a decreased proportion of BFV crews achieving Q1. Moreover, a significant decrease in mean Table VIII first run scores was observed across the two years in which these measures were available from comparison brigade armor units.

Another noteworthy point concerning the downward trend in first-run Table VIII scores is that it was apparently in place prior to SIMITAR training strategy implementation. A sizable drop occurred between 1993 and 1994 among test armor battalions, followed by more decreases in succeeding years. An apparent bottom was reached in 1996, followed by a statistically significant rebound the next year. Although data from comparison units were not available from 1993 through 1995, there was a significant decrease between 1996 and 1997. It may be that bottom was reached in comparison units a year later than in the test brigade. It is also possible that the trend toward lower first-run Table VIII scores had already been set in place by external forces independent of the SIMITAR implementation (e.g., OPTEMPO reductions), and that this trend would have occurred regardless of the particular training activities implemented as part of the SIMITAR training strategy. Unfortunately, this possibility can not be answered definitively in the absence of a rigorously controlled experimental evaluation.

### *Ammunition Expenditure*

The success of SIMITAR in achieving both Table VIII and Table XII qualification in the same training year has raised concerns about increased ammunition requirements. These concerns are potentially exacerbated by decreased Table VIII Q1 rates. If fewer crews qualify Q1, one would expect more rounds to be expended in ultimately attaining Table VIII qualification. And indeed the mean number of main gun rounds expended during Table VIII qualification in the test brigade did increase from pre-SIMITAR to SIMITAR years. The increase, however, was not significant (an average of only 1 round). Also, because test crews

fired Table VII on AFIST, they probably saved enough ammunition to supply their Table XII live-fire needs.

The test brigade was resourced with ammunition for a normal training year (i.e., through Table VIII), and yet it was able to fire Table XII. However, the test brigade was also substantially understaffed during the period of SIMITAR implementation. The extent and prevalence of under-staffing can be observed in the Table XII data tables in the results section, where it can be seen that many companies fielded only two platoons, instead of the three that would be expected of a fully staffed company. It is not clear if this reduced staffing precluded ammunition shortages that would have developed if fully staffed units had attempted both Table VIII and Table XII qualification in the same training year. The interplay of SIMITAR training strategy, ammunition requirements, and TADSS ammunition savings are not fully understood. At this point, it seems a reasonable conjecture that the SIMITAR strategy, through judicious scheduling of TADSS, is capable of permitting both Table VIII and Table XII qualification in the same training year, without additional ammunition requirements. Data from the present investigation, however, did not permit a test of this hypothesis, and it is an issue of sufficient importance to merit further study.

#### *Reduced Staffing and SIMITAR Success*

Reduced staffing could have affected the SIMITAR implementation in yet another way. It will be recalled that a logistic practice known as the “pile-on” weekend (Shaler, 1995) was a key element in delivering the SIMITAR training strategy. In pile-on weekends, TADSS were consolidated at a single location (i.e., an armory, a MATES, or a local training area). With multiple TADSS available at one location, it was possible to rotate intact platoons through available training devices while making other stations available for concurrent maneuver or maintenance training. Most companies, however, were functioning with a reduced number of platoons, raising the question of whether the pile-on concept would have worked as well with a substantial increase in the number of platoons. The pile-on weekend, which proved to be a critically important component of training delivery, needs to be tested within the context of a fully staffed battalion in order to ensure that the concept continues to work under those circumstances.

Although under-staffing is usually thought of as an undesirable state of affairs, it may have actually expedited implementation of the SIMITAR strategy by reducing demands on limited system resources. Fully staffed companies may have placed so much demand on TADSS during pile-on weekends that more devices would have been required. These concerns are mere conjecture, however, and can be evaluated through careful observation of a SIMITAR implementation under conditions of full staffing.

## Conclusions

To a great extent, SIMITAR achieved its goals. The compressed gunnery training strategy has been adopted with enthusiasm. Early Table VIII qualification has become the norm in test units. In fact, some units may have gone too far and introduced too much schedule "compression" by pushing Table VIII qualification out of AT, where the SIMITAR strategy places it, and all the way back to IDT. There was, however, a compelling rationale for this action. The test brigade was anticipating a NTC rotation and saw early completion of Table VIII as the price for buying more time during AT to focus on maneuver training at company and task force levels. This focus upon the forthcoming NTC rotation resulted in a high emphasis on task force maneuver training during AT. With only so much time available, the price for this augmented emphasis on task force maneuver training was reduced emphasis on both Table VIII and Table XII. It is anticipated that future years will see Table VIII qualification returned to the first three days of the AT schedule, and with greater emphasis placed on Table XII qualification.

In the last year of SIMITAR implementation (1997), Table XII qualification was unsatisfactory. But this was hardly surprising, given the difficulty of the table, its logistical complexity, and the impending NTC rotation. Several iterations may be necessary before a unit accumulates a sufficient experience base from which to launch successful assaults on Table XII. But the process has been begun among units of the test brigade, and it has received enthusiastic support from test crews.

Attention now needs to be focused on ways to improve delivery of the SIMITAR gunnery training strategy. Several suggestions for improvement can be advanced: (1) Evaluate the utility of proficiency-based training, geared to expected live-fire outcomes, to optimize the use of TADSS (e.g., Hagman & Morrison, 1996). (2) Avoid over-compression of the gunnery training schedule by conducting Table VIII qualifications during the first three days of AT rather than during IDT. (3) Assess the adequacy of existing TADSS and identify needed improvements. (4) Examine potential ammunition savings resulting from extensive use of TADSS in place of live fire. (5) Determine SIMITAR strategy effectiveness when implemented in full-strength battalions.

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